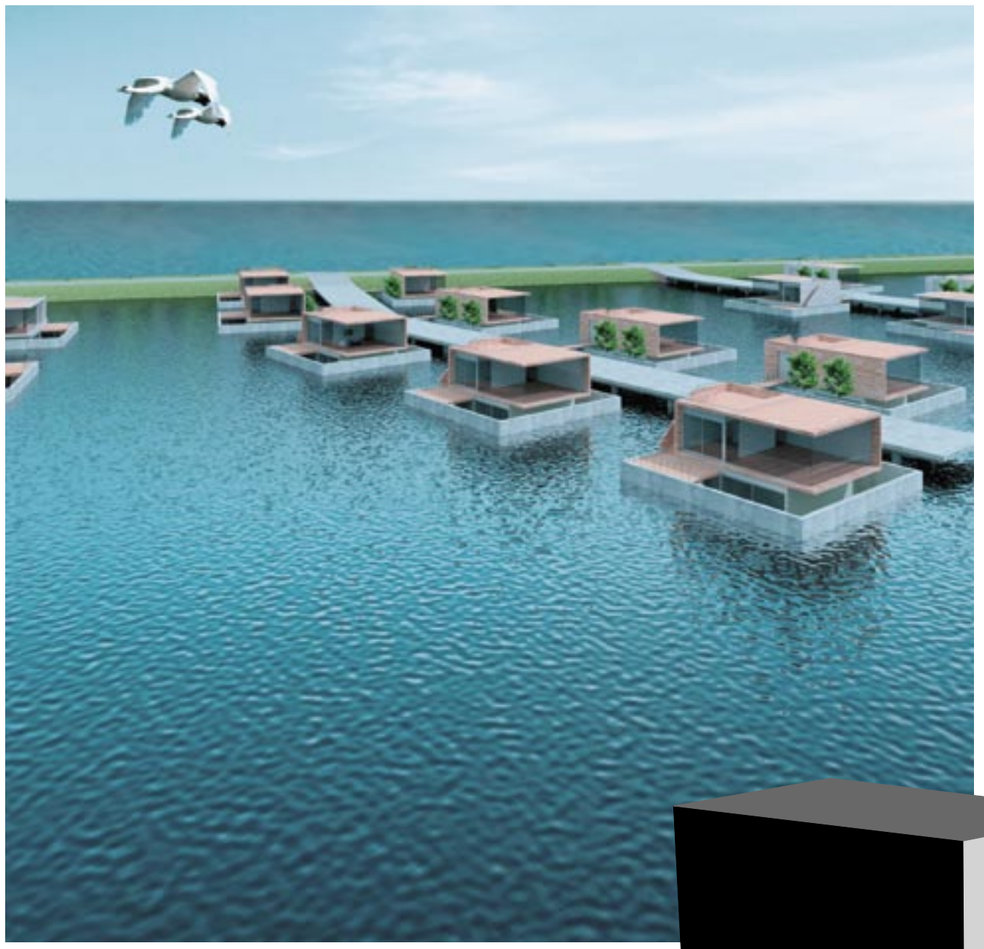

Go with the flow

Housing pressures make flood plain development inevitable. **Philippa Ward** investigates technical fixes to guard against the risks

You pay penalties for living on this small green island: it rains a lot and you are never far from a river. But they can add up to a devastating whole, as they did this summer when thousands of people across the UK watched their homes flood.

More than 1 million people are estimated to have been affected, with the final insurance bill expected to reach more than £2 billion. In Gloucestershire, one of the worst hit areas, 350,000 people were left without clean drinking water, while one in five homes in Hull suffered some damage (*Inside Housing*, 20 July).

In response to such scenes, there were calls for plans to build on flood plains to be scrapped – especially the 160,000 homes earmarked for London's Thames Gateway. Fifty-four per cent of the Thames Gateway growth area lies within a tidal flood zone – quite apart from the possibilities of surface water, groundwater or river flooding.

Despite such statistics being trotted out with increasing regularity, the government shows no sign of listening to the warnings, and homes in the gateway remain under construction.

Environment Agency boss Barbara Young says there is no choice but to build. 'Of course, the easiest and most effective way to reduce the risk of flooding is to avoid new development in the flood plain altogether,' she says. 'But government and regional and local authorities have to balance this with increasing housing pressures, and the benefits that regeneration in the Thames Gateway will bring. The key to success is therefore how we work with planners, developers and architects to accept and manage those risks through better location, resilient design and emergency planning.' In other words, the debate should be focusing on solutions.

One possibility for the Thames Gateway is a second Thames Estuary barrier, which the agency is currently considering. While that may stop damage from a tidal surge coming down the Thames, it will not prevent the kind of floods that have been causing problems elsewhere in England, as in Hull. These happen when the ground becomes saturated and the rivers so full that the water has nowhere to go but onto the surface of the soil, invading homes from below. To live with this kind of flood risk, more complex solutions are needed.

Two years ago, the London Assembly's environment committee warned that rapid development in the Thames Gateway created 'a danger that sites that are most appropriate for this kind of flood management will already have been developed for new homes and businesses', by the time central government took action.

But last December, the government issued policy planning statement 25, to ensure that flood risk is taken into account in planning. '[It] makes local authorities plan for the risk of flooding, avoid inappropriate development and direct development away from areas at

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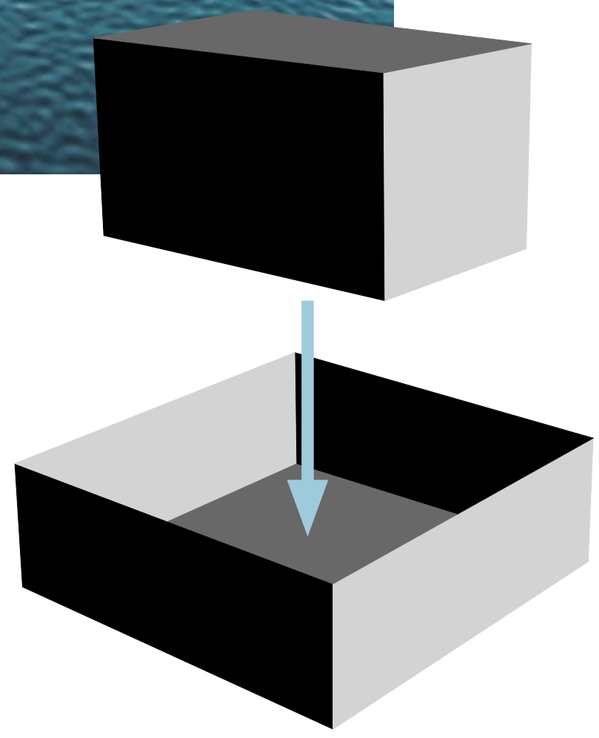
Dutch masters: De Groote Wielen

Like the Thames Gateway to the east of London, De Groote Wielen is an expanding area of development built on the edge of water. The adjoining lake is used to absorb excess rain water, which is filtered by a refining system to keep the water clean.

The Dutch town's planners ran a competition to design homes on four piers projecting into the lake, each of which will hold 10 floating houses. Watergaten, designed by Ronday Winkelaar architects, beat 59 other entries to win the contest. The two-storey house sits inside a floating concrete box (see pictures, left and below). The bedroom and the garden are below water level, giving residents privacy and safety, while the living room and kitchen offer sweeping views over the water. The concrete box collects rainwater that can be used for watering and as 'grey' water, for flushing toilets. The design uses passive sun energy to keep the house at a stable temperature.

'The houses do not oppose the water – they go with the flow, so that they can be placed in any area where water can follow its natural course,' says Maxim Winkelaar, one of the architects behind the design.



All dried up: building on flood plains

When he was entering a competition to design a flood plain development in Gravesend in Kent, Kiran Curtis began to look at best practice for building on flood plains. He says the results were disappointing. 'Largely...it had either been avoided by wholesale land-raising to get above the flood level or simply accepted as the best of a bad job,' he says ruefully.

The planning is still in the early stages but the homes will have a proportion of affordable housing. At the moment, the site is completely cut off from the river behind an ageing sheet pile wall. If the wall was kept and restored, it would need a 10-metre access zone behind it and would have to be built up to 2.4 metres high, completely cutting off the community from the river. All accommodation would have to have been put above street level – resulting in 'dead and lifeless facades at street level and extra building costs,' according to Mr Curtis.

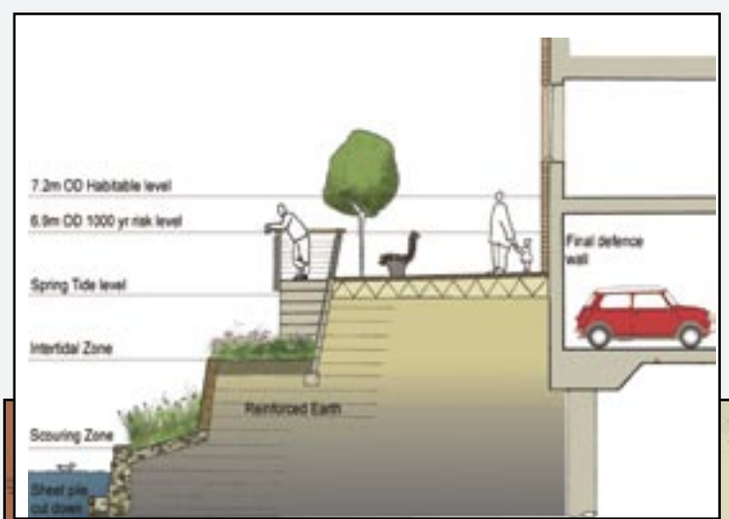
'Instead, we were looking for an alternative type of flood defence, which extends protection and the life of that protection,' he says. The design plan includes landscaped terraces, with the lowest level occupied by salt marsh grasses and sedges. The space includes inlets, viewing platforms and access down the terraces.

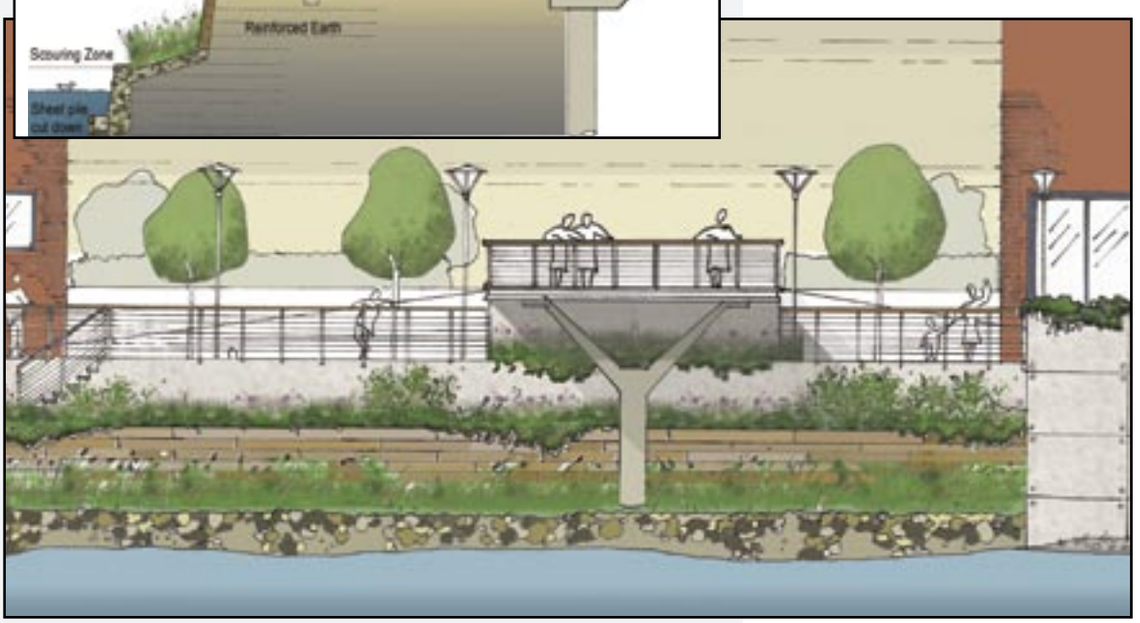
'This type of defence is sustainable, using recycled earth and gravels from the site. It is also easily maintainable and extendable in the future,' says Mr Curtis. 'It actually increases the flood capacity of the river. Best of all, construction costs are around one third of the replacement sheet pile costs.'

In case this first line fails, his team is looking at ways to use the old canal basin as a way to catch excess water and are raising the land level. The ground floor of the developments won't have accommodation, Mr Curtis says. Instead it will include shops, businesses and car-parking.

'The other aspect was designing the public realm and open spaces so if water does get in the site, there is a strategy of where it goes, how it can be pumped out and how to keep people safe,' continues Mr Curtis.

'Look at the north of England, where it may be two years before people can go back to their homes — the design must not just be for the first impact but also look at the consequences of flooding.'





highest risk,' says a Communities and Local Government department spokesperson. 'Independent research by the Association of British Insurers shows that our new policy could cut flood risk by over half in the Thames Gateway.'

Paul Shaffer, a spokesperson for Ciria, a construction improvement body, explains: '[PPS 25] is designed to allow building alongside sustainable development. If you can't choose the safest location for a development, you look at the next safest... It has pushed designing for flood risk to the front of the agenda.' As well as the need for a developer to prove that they couldn't build on a site with lower risk, the policy gives the Environment Agency greater powers to object to planning applications.

Cutting in half the chances of your home being underwater may not be good enough for many – the Thames Gateway area still carries an extremely high flood risk. Some leading architects would rather that flood plains weren't built on at all. But pressure for housing, with the government aiming to build 3 million new homes by 2020, means that the area's developments will go ahead. Flood risk is something that social landlords must consider when they are building new houses.

The good news is that things can be done to reduce the likelihood of flooding in new build developments. If there is excess water, it must have somewhere to go. When you build houses, you put down hard surfaces that don't absorb rainwater, so water runs off tarmac and roofs and collects quickly in low ground. This is where sustainable drainage systems – suds – come in.

'Suds is a different approach to ones used in the past,' says a spokesperson for the Environment Agency. 'It means working with the landscape: using green roofs to absorb the water, or ponds to store it. Other options include swales [shallow ditches] and permeable paving... With this approach, you can improve water quality and provide amenities as well.'

Designing in wetlands and parks, which can flood in times of need, also gives local people green spaces to enjoy. And storing rainwater or putting it gradually into the water table may help with the drought from which the south of England also suffers.

Holding back from developing every inch of available land could also make all the difference. Rather than building right up to the edge of a river, terraced riverbanks allow for rising sea levels in the future, as well as giving space to overflowing rivers. They also give everyone access to a green riverbank, rather than the lucky few with well-placed houses (see box: All dried up).

'There should be a move to much softer defences from barriers such as walls – otherwise we may find in the future that when there is a need to move defences, it can't be done,' adds the agency's spokesperson.

The Greenwich Peninsular, a project funded by regeneration agency English Partnerships that includes affordable and supported housing, was designed like this in 1999. The buildings are set back seven metres from terraced banks to allow for varying water levels. By leaving a 130-metre gap between the development and the riverbank, a salt marsh was created. According to the Environment Agency, the cost of replacing previous flood defences – rigid sheet piling walls – would have been twice the price of this design.

Watertight

The other aspect of planning for flood risk is making sure that the buildings themselves can cope with flooding. This can include low-tech solutions, such as making sure that the electricity points are placed high on the walls of ground floor rooms, or putting in tiles and fittings that can be easily cleaned if there is a flood.

The Royal Institute of British Architects' think tank, Building Futures, has visions of houses on telescopic stilts, seasonal rooms and school boats. But such innovations have their critics. 'Building on jacks or stilts – it's all very futuristic, but I'm sceptical because of the extraordinary cost involved. If it has come to that, perhaps you should think again,' says Kiran Curtis, managing director of KCA architects.

There are less glamorous solutions, like raising the living area up to the first floor. If buildings are some distance from the river, there could be secondary flood defences, such as raised roadways. Other ideas include floating houses [see box] or amphibious buildings that rise and fall with the tide.

Fanciful or practical, the challenge of keeping homes watertight is here to stay. As David Price, an architect at David Price Urban Design, says: 'Designing in the expectation of flooding rather than trying to ignore its possibility or probability is crucial. There is simply no other long-term option.'